



Report to the Committee on Armed
Services, U.S. Senate

March 2007

BEST PRACTICES

An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes



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Why GAO Did This Study

Over the next several years, the Department of Defense (DOD) plans to invest \$1.4 trillion in major weapons programs. While DOD produces superior weapons, GAO has found that the department has failed to deliver weapon systems on time, within budget, and with desired capabilities. While recent changes to DOD's acquisition policy held the potential to improve outcomes, programs continue to experience significant cost and schedule overruns.

GAO was asked to examine how DOD's processes for determining needs and allocating resources can better support weapon system program stability. Specifically, GAO compared DOD's processes for investing in weapon systems to the best practices that successful commercial companies use to achieve a balanced mix of new products, and identified areas where DOD can do better. In conducting its work, GAO identified the best practices of: Caterpillar, Eli Lilly, IBM, Motorola, and Procter and Gamble.

What GAO Recommends

GAO is making several recommendations for DOD to implement an integrated portfolio management approach to weapon system investments. DOD stated that it is undertaking several pilot efforts to improve the department's approach and that implementation of any new business rules will be contingent upon the outcomes of these efforts.

www.gao.gov/cgi-bin/getrpt?GAO-07-388.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Michael J. Sullivan at (202) 512-4841 or sullivanm@gao.gov.

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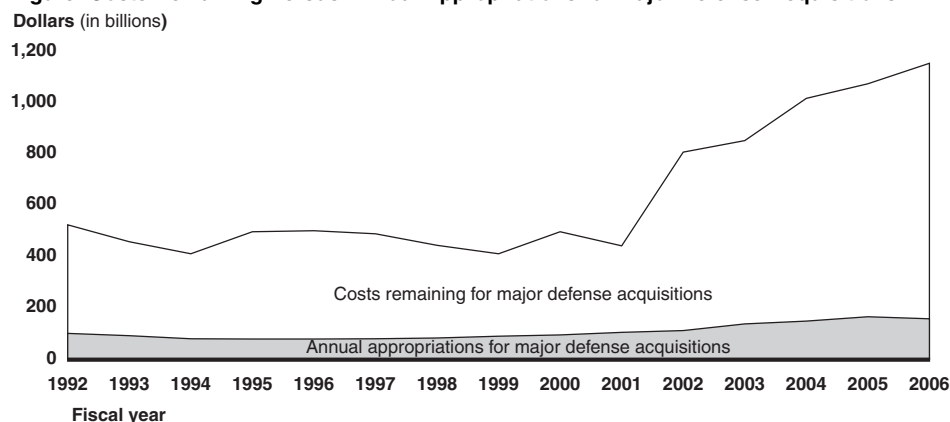
An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes

What GAO Found

To achieve a balanced mix of executable development programs and ensure a good return on their investments, the successful commercial companies GAO reviewed take an integrated, portfolio management approach to product development. Through this approach, companies assess product investments collectively from an enterprise level, rather than as independent and unrelated initiatives. They weigh the relative costs, benefits, and risks of proposed products using established criteria and methods, and select those products that can exploit promising market opportunities within resource constraints and move the company toward meeting its strategic goals and objectives. Investment decisions are frequently revisited, and if a product falls short of expectations, companies make tough go/no-go decisions. The companies GAO reviewed have found that effective portfolio management requires a governance structure with committed leadership, clearly aligned roles and responsibilities, portfolio managers who are empowered to make investment decisions, and accountability at all levels of the organization.

In contrast, DOD approves proposed programs with much less consideration of its overall portfolio and commits to them earlier and with less knowledge of cost and feasibility. Although the military services fight together on the battlefield as a joint force, they identify needs and allocate resources separately, using fragmented decision-making processes that do not allow for an integrated, portfolio management approach like that used by successful commercial companies. Consequently, DOD has less assurance that its investment decisions address the right mix of warfighting needs, and, as seen in the figure below, it starts more programs than current and likely future resources can support, a practice that has created a fiscal bow wave. If this trend goes unchecked, Congress will be faced with a difficult choice: pull dollars from other high-priority federal programs to fund DOD's acquisitions or accept gaps in warfighting capabilities.

Figure: Costs Remaining Versus Annual Appropriations for Major Defense Acquisitions



Source: DOD (data); GAO (analysis and presentation).

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Abbreviations

ACAT	Acquisition Category
AOA	Analysis of Alternatives
AT&L	Acquisition, Technology, and Logistics
DAS	Defense Acquisition System
DOD	Department of Defense
FY	fiscal year
GAO	U.S. Government Accountability Office
IBM	International Business Machines
ICD	Initial Capabilities Document
IPD	Integrated Product Development
JCIDS	Joint Capabilities Integration and Development System
JCS	Joint Chiefs of Staff
JROC	Joint Requirements Oversight Council
JTRS	Joint Tactical Radio System
MS	Milestone
NPV	Net Present Value
OSD	Office of the Secretary of Defense
PA&E	Program Analysis and Evaluation
PPBE	Planning, Programming, Budgeting, and Execution
RDT&E	research, development, test, and evaluation
USD	Under Secretary of Defense

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United States Government Accountability Office
Washington, DC 20548

March 30, 2007

The Honorable Carl Levin
Chairman
The Honorable John McCain
Ranking Member
Committee on Armed Services
United States Senate

Although the Department of Defense (DOD) produces the best weapons in the world, it has not been able to deliver planned systems on time and within budget. It is not unusual to see cost increases that add up to tens or hundreds of millions of dollars, schedule delays that add up to years, and large and expensive programs being scrapped after years of failing to achieve promised capabilities.¹ While recent changes to DOD's acquisition policy held the potential to improve such outcomes, programs have continued to experience significant cost and schedule overruns and performance shortfalls.² Over the next several years, DOD plans to invest \$1.4 trillion in major weapon system programs—doubling what it planned to spend on such programs 5 years ago. Continued failure to deliver weapon systems on time and within budget not only delays providing critical capabilities to the warfighter, but results in less funding being available for other DOD and federal priorities.

In the commercial market, effectively developing and marketing new products is fundamental to the continued growth and success of companies. Without a steady stream of product innovations to meet evolving market needs, companies are likely to see their sales and profits fall. At the same time, if the products in development outstrip their resources or do not meet customer needs, companies can face financial ruin. Several recent studies issued by leading thinkers in the area of product innovation and development have reported that leading commercial companies achieve success in product development by

¹GAO, *Defense Acquisitions: Actions Needed to Get Better Results on Weapons Systems Investments*, [GAO-06-585T](#) (Washington, D.C.: Apr. 5, 2006).

²GAO, *Defense Acquisitions: Major Weapon Systems Continue to Experience Cost and Schedule Problems under DOD's Revised Policy*, [GAO-06-368](#) (Washington, D.C.: Apr. 13, 2006).

following a disciplined process for ensuring they have the right mix of new products that meet customer needs within available resources.

In fiscal year 2006, the Senate Armed Services Committee raised concerns that DOD's poor track record with acquisition programs was linked not only to the department's Defense Acquisition System (DAS) for managing product development, but also to the department's Joint Capabilities Integration and Development System (JCIDS) for identifying the warfighters' needs and the Planning, Programming, Budgeting and Execution (PPBE) process for allocating resources. Consequently, the Committee directed GAO to examine how DOD's needs identification and resource allocation processes can better support program stability in major weapon systems acquisition.³ This report (1) identifies best practices of successful commercial companies for ensuring that they pursue the right mix of programs to meet the needs of their customers within resource constraints and (2) compares DOD's enterprise-level processes for investing in weapon systems to these practices.⁴

To identify best practices of successful companies, we reviewed related professional and academic publications, and interviewed knowledgeable officials from five successful commercial companies: Caterpillar, Eli Lilly, IBM, Motorola, and Procter & Gamble. While the products developed by these companies range from heavy construction equipment and high-end electronics to pharmaceuticals and household items, each of the companies manages a large diversified portfolio of products, spends billions of dollars annually on research and development, and has thousands of employees worldwide. To examine DOD's processes for making investment decisions, we reviewed related legislation and DOD directives, instructions, and guidance; conducted interviews with and received briefings from relevant Joint Staff, Office of the Secretary of Defense (Comptroller, Program Analysis and Evaluation, and Acquisition, Technology and Logistics), and other government officials; reviewed current literature assessing DOD's decision-making processes; and analyzed DOD requirements documents. We compared DOD's enterprise-level practices to commercial best practices to identify potential areas for

³S.Rep.No. 109-69 at 343-346 (2005).

⁴The Senate mandate specifically asked GAO to review the requirements and budgeting portions of DOD weapon system acquisition. Therefore, we do not focus on the DAS in this report. GAO has, however, produced a body of best practices work focusing on the DAS; many of those reports are listed in the related GAO products section of this report.

improvement. For additional details on how we performed our review, see appendix I. Our work was conducted between March 2006 and February 2007 in accordance with generally accepted government auditing standards.

Results in Brief

Successful commercial companies use an integrated portfolio management approach to prioritize market needs and allocate resources; thus, they avoid pursuing more products than their resources can support and optimize the return on their investment. Through portfolio management, all of a company's product investments are addressed collectively from an enterprise level, rather than as independent and unrelated initiatives. Potential product developments are identified and assessed through a systematic and disciplined screening process. Companies weigh the relative costs, benefits, and risks of each proposed product using established criteria and methods to select the best mix of products to develop. They not only select those products that have a sound business case to warrant further investment, but also those that help the company balance near- and future-term market opportunities, different product lines, and available resources against the demand for product investments. Once initial investment decisions are made, they are revisited at multiple stages throughout product development in a gated review and assessment process to ensure products are still of high value. If not, companies make tough decisions to defer or terminate investments and rebalance their product portfolios. To be effective, portfolio management is enabled by strong governance with committed leadership, clearly aligned organizational roles and responsibilities, empowered portfolio managers who determine the best way to invest resources, and accountability at all levels of the organization.

Although the military services fight together on the battlefield as a joint force, they do not identify warfighting needs and make weapon system investment decisions together in an integrated manner. DOD has taken steps to identify warfighting needs through a joint requirements process, but its service-centric structure and fragmented decision-making processes do not allow for the portfolio management approach used by successful commercial companies to make investment decisions that benefit the organization as a whole. DOD largely continues to define warfighting needs and make investment decisions on a service-by-service basis, an approach that has contributed to duplication in programs and equipment that does not operate effectively together. Also, DOD assesses warfighting needs and their funding implications under separate decision-making processes, impeding its ability to prioritize warfighting needs so

that it pursues not only the ones that are most important but also the ones it can afford. While DOD's JCIDS process provides a framework for reviewing and validating the initial need for proposed capabilities, it does not focus on the cost and feasibility of acquiring the capability to be developed and fielded. Instead, these considerations are addressed through separate budgeting and acquisition processes. Moreover, although DOD policy provides for a series of early reviews—focused on the concept refinement and technology development phases of proposed weapon system programs—in prior work we found that the reviews are often skipped or are not fully implemented. Consequently, proposed programs build momentum and move toward starting product development with little if any early department-level assessment of the costs and feasibility. Committing to programs before they have this knowledge contributes to poor cost, schedule, and performance outcomes and destabilizes acquisition programs as the department attempts to pay for poorly performing programs by taking funds from others.

The department has begun to pilot-test several interrelated initiatives intended to address shortfalls in its existing approach to investment decisions. These initiatives include a new approach to an early decision gate for reviewing proposed programs at the concept stage, testing portfolio management approaches in selected capability areas, and setting up capital budgeting accounts for programs in development. However, as currently structured, the initiatives are intended to operate within DOD's existing organizational and process framework and may not allow for sufficient authority and control over resources to effectively influence weapon system investments.

To improve DOD's ability to deliver a balanced mix of weapon system programs at the right time and right cost, we are recommending the department establish an integrated, portfolio-based approach to investments that incorporates best practices of successful commercial companies. To ensure the success of such an approach, we are also recommending that DOD establish a single point of accountability at the department level with the responsibility, authority, and accountability for ensuring that portfolio management for weapon system investments is effectively implemented across the department. DOD concurred with the majority of our recommendations and partially concurred with two. Generally, in responding to these recommendations, DOD stated that it is undertaking several initiatives and pilot efforts to improve the department's approach to investment and program decision making, and that implementation of any new business rules will be contingent upon the outcome of these initiatives. However, we believe the department's

current initiatives do not fundamentally change DOD’s service-centric framework or sufficiently integrate its decision-making processes. DOD did not provide comments regarding our recommendation that the Secretary establish a single point of accountability.

Background

DOD’s programs for acquiring major weapon systems have taken longer, cost more, and delivered fewer quantities and capabilities than planned. We have documented these problems for decades. Most recently, we reported that 27 major weapon programs we have assessed since they began product development have experienced cost increases of nearly 34 percent over their original research, development, test, and evaluation (RDT&E) estimates, and increases of almost 24 percent in acquisition cycle time (see table 1).⁵

Table 1: Cost and Cycle Time Growth for 27 Weapon Systems

Billions of constant 2007 dollars			
	First full estimate	Latest full estimate	Percentage change
Total cost	\$506.4	\$603.1	19.1
RDT&E cost	\$104.7	\$139.7	33.5
Weighted average acquisition cycle time ^a	137.9 months	170.2 months	23.5

Source: GAO analysis of DOD data.

^aThis is a weighted estimate of average acquisition cycle time for the 27 programs based on total program costs at the first full and latest estimates. The simple average for these two estimates was 98.9 months for the first full estimate and 124.6 months for the latest estimate resulting in a 26.1 percent change.

When cost and schedule problems occur in one program, DOD often attempts to pay for the poorly performing program by taking funds from others. Doing so has destabilized other programs and reduced the overall buying power of the defense dollar as DOD and the military services are forced to cut back on planned quantities or capabilities to stay within budget limitations. The F-22A Raptor program is a case in point: As costs escalated in the program, the number of aircraft the Air Force planned to buy was drastically reduced from 648 to 183. Similarly, as the Joint Tactical Radio System (JTRS) encountered development problems, the number of requirements was reduced or deferred by about one-third. As a result, several programs that were dependent on JTRS also had to make

⁵GAO, *Defense Acquisitions: Assessments of Selected Major Weapon Programs*, [GAO-07-406SP](#) (Washington, D.C.: Mar. 30, 2007).

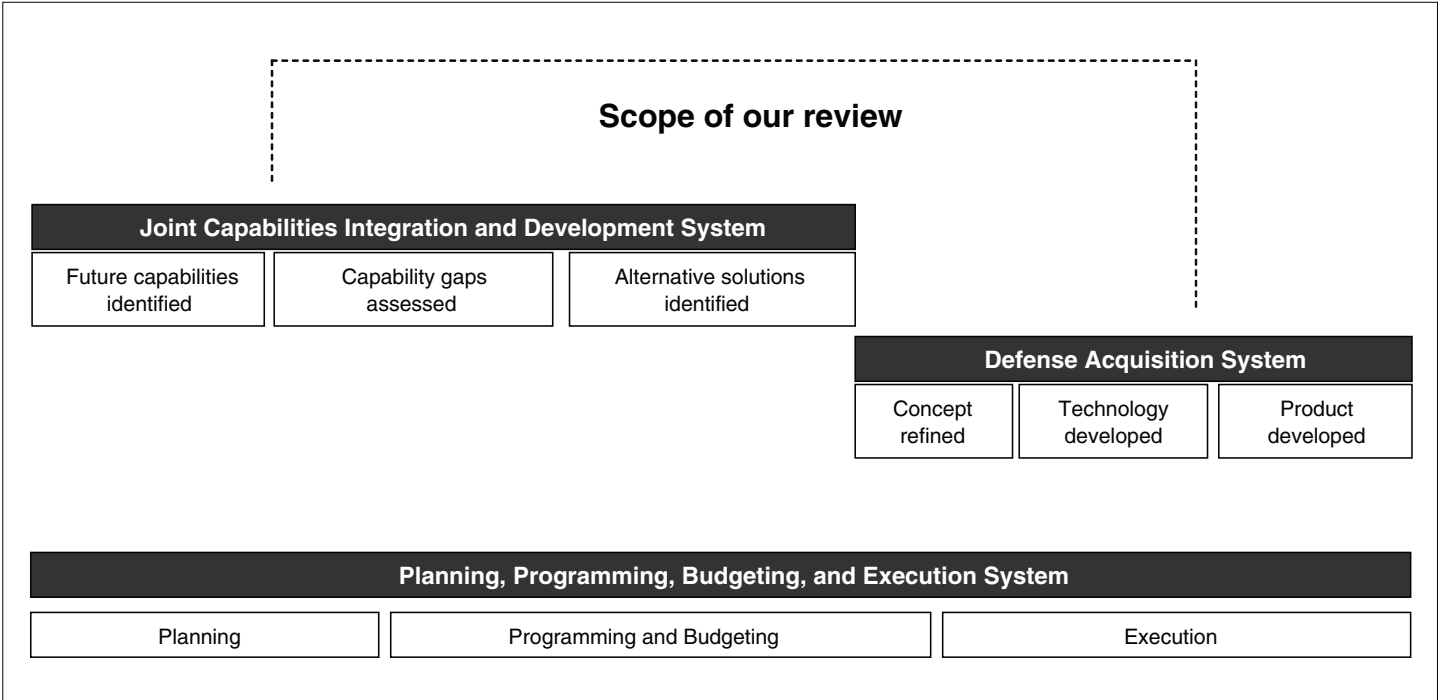
adjustments and go forward with alternative, less capable solutions. DOD's approach to managing weapon system investments ultimately results in less funding being available for other competing needs in DOD as well as other federal priorities, as the expenditure of tax dollars within DOD reduces the amount of funding available for those priorities.

Taking into account the differences between commercial product development and weapons acquisitions, we have recommended that DOD adopt a knowledge-based, incremental approach to developing and producing weapon systems. This type of an approach requires program officials to demonstrate that critical technologies are mature, product designs are stable, and production processes are in control at key junctures in the acquisition process.⁶

DOD has three major processes involved in making weapon system investment decisions. These processes, depicted in figure 1, are the Joint Capabilities Integration and Development System (JCIDS), for identifying warfighting needs; the Planning, Programming, Budgeting and Execution (PPBE) system, for allocating resources; and the Defense Acquisition System (DAS), for managing product development and procurement. Much of our prior work has focused on identifying commercial best practices that could be used to improve the Defense Acquisition System—from the point just before product development starts onward. In this report, however, we look at earlier stages in DOD's investment process—from the point where gaps in warfighting capability are assessed in JCIDS through the point where alternative solutions to resolve those gaps are analyzed under the DAS (see fig. 1).

⁶GAO, *Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes*, [GAO-02-701](#) (Washington, D.C.: July 15, 2002); *Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes*, [GAO-01-288](#) (Washington, D.C.: Mar. 8, 2001); and *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes*, [GAO/NSIAD-99-162](#) (Washington, D.C.: July 30, 1999).

Figure 1: DOD’s Weapon System Investment Process



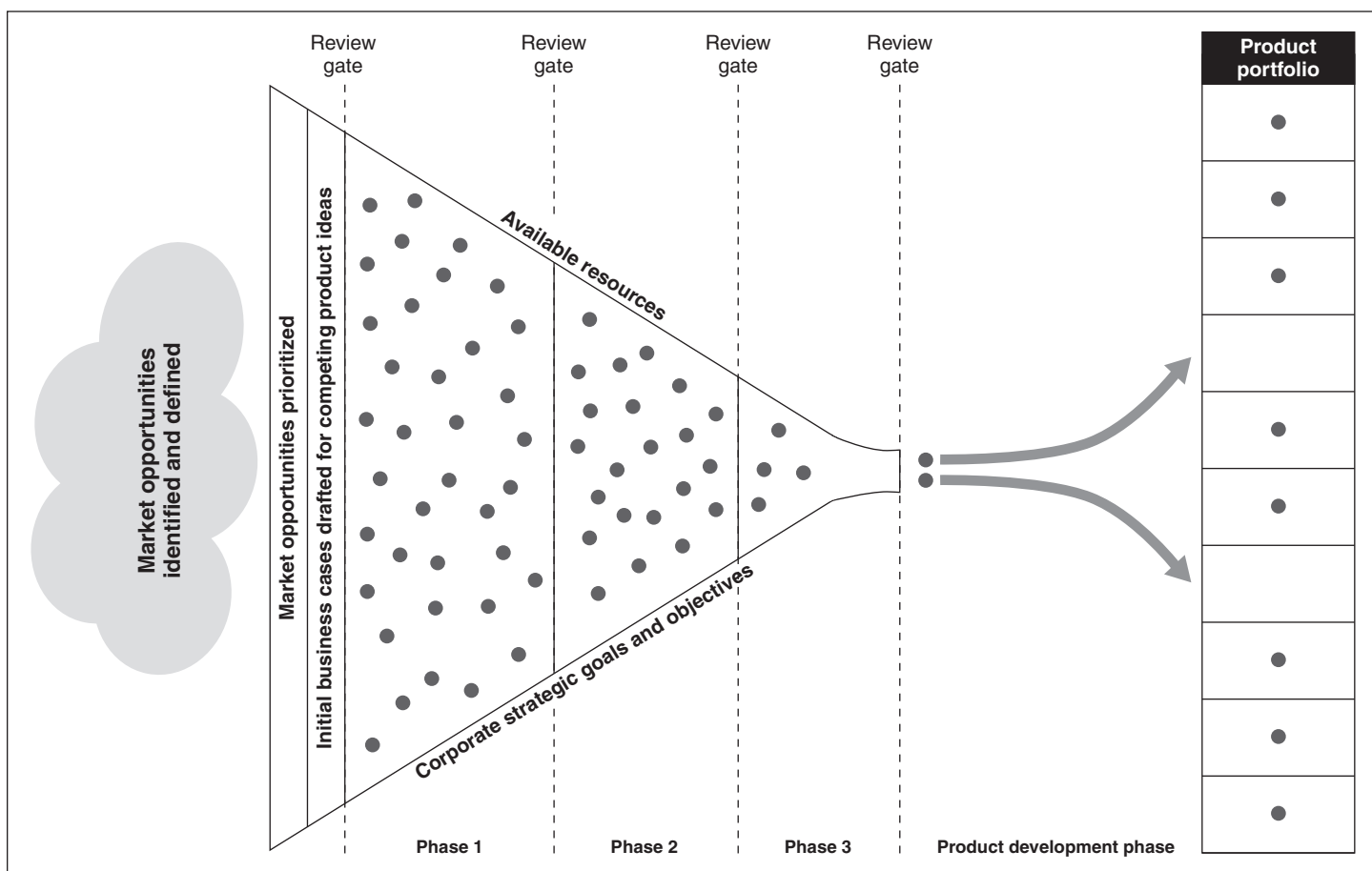
Source: DOD (data); GAO (analysis and presentation).

Successful Companies
Take a Disciplined,
Integrated Approach
to Prioritize Market
Needs and Initiate a
Balanced Mix of
Executable
Development
Programs

To ensure they achieve a balanced mix of executable development programs, the successful commercial companies we reviewed use a disciplined and integrated approach to prioritize market needs and allocate resources. This approach, known as portfolio management, requires companies to view each of their investments from an enterprise level as contributing to the collective whole, rather than as independent and unrelated. With this enterprise viewpoint, companies can effectively (1) identify and prioritize market opportunities and (2) apply available resources to potential products to select the best mix of products to exploit the highest priority—or most promising—opportunities. Ultimately, each of the companies we reviewed seeks to achieve a balanced portfolio that maximizes the return on investments and moves the company toward achieving its strategic goals and objectives. This type of approach depends on strong governance with committed leadership, clearly aligned responsibility, and effective accountability at all levels of the organization.

As depicted in figure 2, a portfolio management approach begins with an enterprise-level identification and definition of market opportunities and then the prioritization of those opportunities within resource constraints. Once opportunities have been prioritized, companies draft initial business cases for alternative product ideas that could be developed to exploit each of the highest priority opportunities. Each alternative product proposal—represented by a black dot—enters a gated review process. At each review gate, product proposals are assessed against corporate resources, established criteria, competing products, and the goals and objectives of the company as a whole. As alternatives pass through each review gate, the number is expected to decrease, until only those alternatives with the greatest potential to succeed make it into the product portfolio.

Figure 2: Portfolio Management Approach to Product Investments



Source: GAO analysis and presentation of commercial best practices.

Identifying and Prioritizing Market Opportunities Lays the Foundation for Achieving the Right Mix of Products

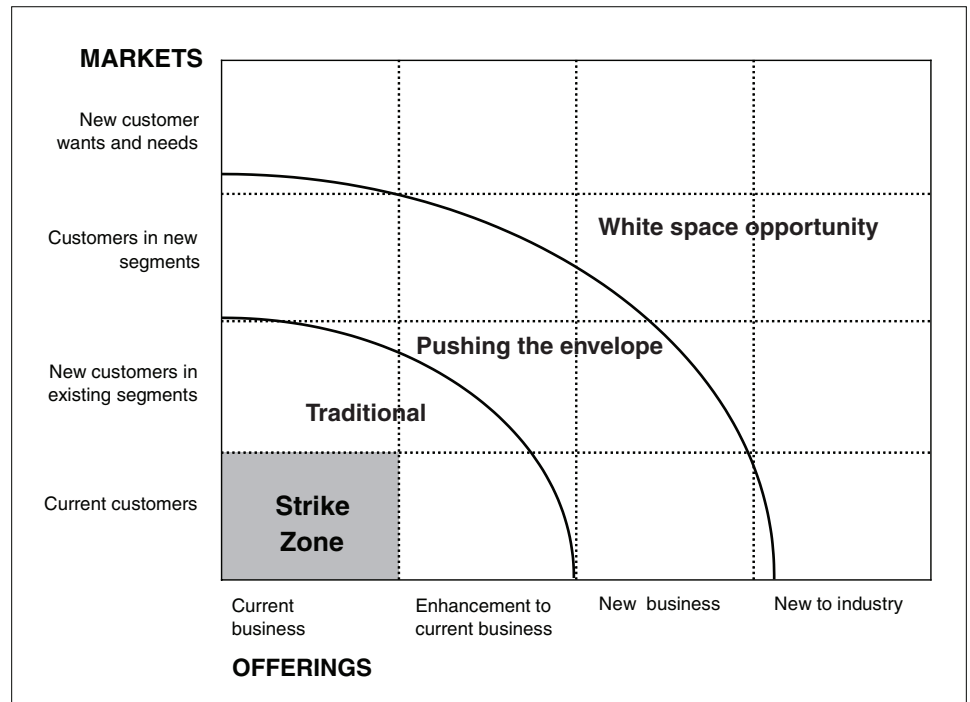
To make informed decisions about what market opportunities to target, the companies we reviewed first establish a strategy that lays out the overall goals, objectives, and direction for the company. As part of their strategy, companies identify enterprise-level sales and profit targets, strategic business areas they want to focus on, the extent to which current products and new development efforts will support their growth objectives, and how they will allocate resources across business units and functional areas. This strategy provides a framework for the companies' investment decisions. Within this framework, companies conduct a series of market analyses to develop a comprehensive understanding of the

market environment, including product trends, technology trends, and customer needs.

IBM for example, follows a structured market planning process to identify, prioritize, and target attractive market segments. The first phase of this process, called Market Definition, focuses on understanding the marketplace, including identifying potential customers and their needs.⁷ During this phase, IBM examines the marketplace and technology environments and identifies attractive market segments that contain potential market opportunities—where customer wants or needs exist. Each segment is categorized into one of four areas based on needs of the customers and the company’s product offerings (see fig. 3): “strike zone,” “traditional,” “pushing the envelope,” and “white space.” The strike zone represents IBM’s core business—market segments where IBM has an established customer base that it is successfully serving with existing product offerings. In contrast, white space represents market segments of new customers with wants and needs that are new and different for IBM. White space opportunities often require discovery and innovation. The traditional and pushing the envelope areas fall between the strike zone and white space. Traditional opportunities exist when new customers could be attracted to an existing market—one IBM is already active in—by modifying or enhancing existing products or services. Pushing the envelope opportunities exist where the needs of current customer groups move them into a new market segment. These attractive market segments are prioritized during the next phase of IBM’s process, known as the Capability Assessment phase. During this phase each segment’s overall attractiveness and potential profitability are assessed, along with IBM’s available resources—like capital, cash, and current products—and its competitive position within each segment. This analysis leads to the selection of targeted market segments.

⁷IBM focuses on providing its customers with what it calls “industry integrated solutions.” As a result, portfolios within IBM are structured around the customers’ and buyers’ behaviors and needs and not on specific product offerings. In other words, the company focuses on providing functional solutions to the customers, which could be done with a number of product offerings and services, and not simply limiting themselves to narrowly focused, single product solutions that the customer can take or leave, an approach that IBM believes caused problems for the company in the past.

Figure 3: IBM Market Segmentation



Source: IBM's IPD process (data); GAO (analysis and presentation).

Motorola emphasizes the importance of targeting the right market segments at the enterprise level to ensure that a balanced mix of project and resource investments is maintained. Officials noted that excessively focusing on segments that require new and innovative products can result in long cycle times, wasted money, and lost opportunities elsewhere. Likewise, critical opportunities can be lost when too much emphasis is placed on simply continuing to invest in old markets with old products. According to the officials we spoke with, the current investment mix for Motorola's Government and Enterprise Mobility Solutions business unit is roughly 70-20-10, where 70 percent of its projects and resources are dedicated to maintaining its core business, while 20 percent are invested in pursuing new markets with existing products or introducing new or enhanced products into existing markets, and the remaining 10 percent are dedicated to discovering new markets and new products.

As part of their market analyses, companies increasingly refine their understanding of who their customers are and what they need. For several of the companies we met with, determining the needs of their customers is

complex because they have multiple groups of customers to consider. For example, Eli Lilly has four customer groups with diverse needs: patients, doctors, insurance companies, and government regulators. This complexity is compounded when considering that success in a worldwide market is critically dependent on a company's ability to operate within different governmental systems, laws, and regulations; and regional markets. Several of the companies we reviewed use a variety of methods—including interviews, surveys, focus groups, and concept tests—to actively engage their customers and help determine what they need. Some companies also observe customer behaviors to identify unstated wants and needs that if met—assuming corporate knowledge and resources allow—could actually exceed customer expectations. While companies actively seek customer input to identify products that show the most promise and satisfy customer needs, customers generally do not identify specific products to be developed.

Companies Follow a Disciplined Process to Identify New Products and Achieve a Balanced Portfolio

Once companies have identified and prioritized their market opportunities, they follow a disciplined process to assess the costs, benefits, and risks of potential product alternatives and allocate resources to achieve a balanced portfolio that spreads risk across products, aligns with the company's strategic goals and objectives, and maximizes the company's return on investment. At an early stage, each alternative product is expected to be accompanied by an initial business case that contains knowledge-based information on strategic relevance and estimates of cost, technology maturity, and the cycle time for getting the product from concept to market. To ensure comparability across alternatives, companies require initial business case information to be developed in a transparent manner, to use specific standards, and to report estimates within certain levels of confidence or allowable deviations. Each of the companies we reviewed also stressed the importance of having multiple management review points, or gates, at early phases to assess and prioritize alternative products. As products move through review gates, from ideas, to more concrete concepts, to the start of development where a final business case is made, companies expect uncertainties—which are typically inherent in the early phases—to be addressed and estimates to become more precise. Consequently, the number of viable alternatives tends to decrease at each review gate as those with the lowest potential for success and least value are terminated or deferred, while those that are poised to succeed and providing the best value are approved to proceed (illustrated in fig. 2). Companies emphasized that making tough go/no-go decisions is critical to keeping a balanced portfolio. Over time, as potential new products are identified, companies review them against other product investments

(proposed and existing) and rebalance their portfolios based on those that add the most value.

The companies we visited each follow a disciplined, gated review process to ensure that they commit to development programs that help balance the portfolio and that are executable given available corporate resources. This allows companies to avoid committing to more programs than their resources can support and ensure stability in the programs they invest in. Although the number of review gates prior to the start of full-scale product development varied between companies—ranging from four at Procter & Gamble, to eight at Motorola—they all required potential products to follow an established, disciplined process and meet specified criteria at each review point. For example, Caterpillar assesses product alternatives at four review gates prior to the start of development—three of which were recently added to enhance the rigor of its investment decision making. Each alternative must be supported by a draft business case that includes quantifiable data that can be compared with specific standards and used to determine if the related product can move past that gate. At each gate, alternatives are reviewed to ensure that knowledge about critical technologies, life-cycle costs, product reliability, and product affordability is being acquired and that the product contributes to achieving the company’s strategic goals and objectives.

Because developing a new drug is costly and time consuming, Eli Lilly requires that the data supporting potential new drugs must meet high standards to ensure that managers are informed to make sound investment decisions.⁸ Each potential new drug must be supported by an initial business case that contains information about safety and efficacy; forecasted revenue; expected unit demand; capital, medical, supply and material, development, and selling and marketing expenses; and general administrative costs. The initial business case must also identify critical success factors, state the probability of technical success, and provide a timeline that details when major milestone events are expected and how long it will take to get the associated drug to market. Eli Lilly assesses, approves, and funds proposed new drugs incrementally. At each milestone review a contract is established between the project team and a gatekeeper committee, which contains deliverables, time frames, and the

⁸According to Eli Lilly representatives, the average cost to discover and develop a new drug ranges from \$800 million to \$1 billion, and the average length of time to get a new drug from discovery to the market is 10 to 15 years.

costs to get to the next milestone. Once this contractual agreement is reached the budget is allocated for the entire phase. The gatekeeper committees expect each new drug proposal to achieve an 80-percent confidence level in their cost and schedule estimates for the next phase. This high level of confidence is achievable in large part because final budget estimates are not developed by project teams until 2 months prior to the milestone review. Projects are terminated at early points in the review process when it is determined that their critical success factors cannot be achieved. Because Eli Lilly's projects typically have a high degree of technical risk, only about 1 percent of those that start early development actually make it to the marketplace.

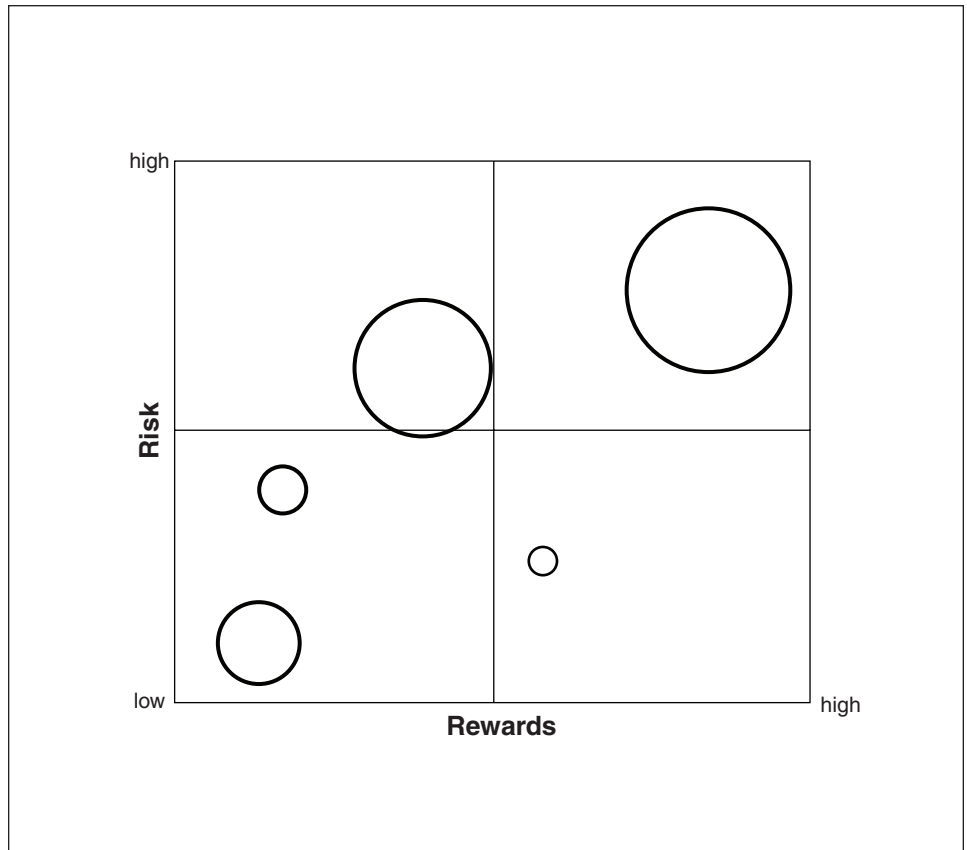
Motorola officials also emphasized the importance of having sound information when assessing potential new products. They noted that a process without sound information will not produce good outcomes. Therefore, Motorola's Government and Enterprise Mobility Solutions business unit expects potential products to be supported by initial business cases containing data that meet specific standards and levels of confidence at each review gate. For example, cost estimates for potential products are developed in several phases and are expected to increase in confidence with each successive phase. Early in the investment planning, when an initial business case is first drafted, the confidence parameters are generous, ranging from as much as 75 percent higher to as much as 25 percent lower than what the project will likely end up costing. By the time a product alternative reaches the beginning of product development, when a final business case is made, Motorola expects the cost estimates to be at confidence levels of 10 percent higher and 5 percent lower. Proposed products that fail to meet the specified criteria at early review gates are either terminated or sent back to further mature and reenter the review process from the beginning.

The companies we reviewed use a variety of portfolio management tools and methods to inform the investment and resource allocation decisions they make at each review gate. Some companies employ scoring methods, using experts to rate products based on a number of factors—such as strategic fit, risk, and economic value—and use that information to prioritize alternative products. Another common tool plots alternative products on a decision matrix that compares factors such as costs and benefits, or risks and rewards of competing alternatives. Using this type of matrix, alternative products are often represented by circles, where the

size of the circles provides information about key constraints such as available annual resources or the estimated annual costs for each alternative. For example, figure 4 compares risk and expected rewards⁹ by plotting competing alternatives on a matrix. Alternatives that fall into the upper left quadrant are high risk and low reward, while alternatives that fall into the lower right quadrant are low risk and high reward. By weighing risk against rewards and considering constraints such as annual resources or annual cost, this tool provides critical information and a structured means to help managers make informed decisions. Company officials at Procter & Gamble emphasized the importance of selecting a balanced mix of products to pursue. They noted that pursuing only low-risk and high-reward products at the expense of more innovative, higher-risk products could cause the company to miss out on opportunities to improve their competitive standing in the marketplace. Likewise, excessive pursuit of higher-risk products with the potential for high returns could also result in lost opportunities to elsewhere.

⁹Companies commonly measure rewards and benefits using cash flow analysis known as net present value (NPV) analysis. NPV techniques can show, in today's dollars, the relative net cash flow of various alternatives over a long period of time. Simply stated, net cash flow is the amount of dollars that is left after sales and revenues have offset expenses. In general, the greater the net cash flow for a particular investment, the greater the return on the investment.

Figure 4: Risk Versus Rewards Matrix



Source: GAO.

Recognizing the inherent risks in pursuing a new development program—that overruns or underruns in one business case result in lost opportunity to invest resources in another worthwhile project—IBM permits products to deviate from their original business case estimates as long as the deviation is within established limits. These limits are specified in a contractual document resulting from negotiations between senior management and project managers and signed at the beginning of product development. Product development teams are expected to execute according to the contract; if established thresholds are breached, action is taken immediately to reassess the product within the context of the portfolio and determine whether it is still a relevant and affordable investment to pursue.

Successful Portfolio Management Requires Strong Governance with Committed Leadership, Empowered Decision Makers, and Effective Accountability

Successful portfolio management requires strong governance with committed leadership that empowers portfolio managers to make decisions about the best way to invest resources and holds those managers accountable for the outcomes they achieve. The companies we reviewed indicated that it is critical to have commitment from the top leaders of the organization and recognition at all levels that what is best for the company must be a priority, and not simply what is best for a particular business unit or product line. In addition, the companies emphasized that roles and responsibilities for implementing portfolio management, including the designation of who is responsible for product investment decisions and oversight, must be clearly defined. Because portfolio managers are on the front line, the companies we reviewed empower these managers to make product investment decisions and hold them accountable for outcomes, not just for individual products but also for the overall performance of their portfolios. To support their portfolio managers, the companies encourage collaboration and communication, including sharing bad news early. Several companies also emphasized the importance of supporting their portfolio managers with cross-functional teams, composed of representatives from the key functional areas within the company—such as science and technology, marketing, engineering, and finance—to ensure that they are adequately informed when making investment decisions. To ensure accountability, companies often use incentives and disincentives, including promotion and termination. We have previously reported that high-performing organizations have monetary and other rewards that clearly link employee knowledge, skills, and contributions to achieving the organization's goals and objectives.¹⁰ These organizations underscore the importance of holding individuals accountable and aligning performance expectations with organizational goals and cascade those expectations down to lower levels. Companies stressed that the transformation to portfolio management takes time and requires not only process changes but cultural changes throughout the company.

Eli Lilly emphasized that a key to making its portfolio management process work is having a single committee with a high-level official in charge responsible for making product investment decisions. Previously, the company had a multi-layered committee structure in place, and decisions were made based on reaching a consensus—an approach that

¹⁰GAO, *Results-Oriented Cultures: Creating a Clear Linkage between Individual Performance and Organizational Success*, [GAO-03-488](#) (Washington, D.C.: Mar. 14, 2003).

was viewed as cumbersome and lengthy. Eli Lilly also ensures accountability by directly linking management and employee bonuses to the overall success of the company. Individual employee performance objectives are aligned with specific company objectives, such as meeting budgetary goals, time frames, and data quality levels for a given project. Achievement of individual employee objectives is measured periodically to provide feedback to the employee. Eli Lilly officials stressed that having the right performance metrics in place is important because ultimately you get what you measure; therefore, be sure to measure the right things.

Motorola considers accountability to be the critical factor in making its portfolio management process successful. In addition, Motorola's culture is not averse to reporting bad news to management. Project managers are encouraged to report problems early so that they can be addressed before they get out of control. Senior managers, however, are not intimately involved in the day-to-day decision making for individual products. That responsibility, in nearly every case, is delegated to the business unit general manager. The general manager of a business unit is held accountable for ensuring that the products within his unit succeed at all levels. The general manager is responsible for holding product managers accountable for the attainment of critical knowledge at key points and the performance of their individual products overall. General managers and product managers can be fired for not meeting objectives. Motorola believes that if managers are held accountable for results, then they have more desire to get it right.

Lacking an Integrated, Portfolio-Based Approach, DOD Has Too Many Programs Competing for Limited Resources

Although the military services fight together on the battlefield as a joint force, they do not identify warfighting needs and make weapon system investment decisions together. DOD has taken steps to identify warfighting needs through a more joint requirements process, but the department's service-centric structure and fragmented decision-making processes are at odds with the integrated, portfolio management approach used by successful commercial companies to make enterprise-level investment decisions. Consequently, DOD has less assurance that its weapon system investment decisions address its most important warfighting needs and are affordable in the context of its overall fiscal resources. In addition, DOD commits to products earlier than the companies we reviewed and with far less knowledge about their cost and feasibility. This leads to poor program outcomes and funding instability, as the department attempts to fix troubled programs by taking funds from others.

Service-centric Structure and Fragmented Decision-making Processes Impede DOD's Ability to Prioritize Warfighting Needs

Although recent DOD policy emphasizes a more joint approach to identifying and prioritizing warfighting needs,¹¹ DOD's service-centric structure and fragmented decision-making processes hinder the policy's successful implementation. This policy, which introduced the JCIDS process, calls for a wider range of stakeholders than before, including more customer (i.e., combatant command) involvement; introduces new methodologies intended to foster jointness; and groups warfighting needs into eight functional areas based on warfighting capabilities—such as netcentric, force application, and battlespace awareness¹²—that cut across the military services and defense agencies. The JCIDS process emphasizes early attention to the fiscal implications of newly identified needs, including identifying ways to pay for new capabilities by divesting the department of lower priority or redundant capabilities. Despite these provisions, assessments of warfighting needs continue to be driven by the services and to be based on investment decision-making processes that do not function together to ensure that DOD pursues needs that its resources can support.

The military services identify warfighting needs individually, and department-level organizations are not optimized to integrate the services' results or evaluate their fiscal implications early on. Historically, this approach has contributed to duplication in weapon systems and equipment that does not interoperate. At the department level, Functional Capability Boards oversee each of the eight functional areas, reviewing the services' assessments, and providing recommendations to the Joint Requirements Oversight Council (JROC), which leads the JCIDS process. However, defense experts and DOD officials report that the Functional Capability Boards do not have the staff or analytical resources required to effectively evaluate service assessments within the context of the broader capability portfolio and assess whether the department can afford to address a particular capability gap. Several recent studies have recommended that DOD increase joint analytical resources for a less

¹¹Chairman of the Joint Chiefs of Staff Instruction, Joint Capabilities Integration and Development System, CJCSI 3170.01E (May 11, 2005). The original instruction was CJCSI 3170.01C (June 24, 2003).

¹²The other capability areas are command and control, focused logistics, force management, force protection, and joint training.

stovepiped understanding of warfighting needs.¹³ In addition, the boards lack the authority to allocate resources and to make or enforce decisions to divest their capability area of existing programs to pay for new ones—authority successful companies provide to their portfolio managers. Finally, some defense experts contend that the service ties of JROC’s members—that is, the services’ Vice Chiefs and the Assistant Commandant of the Marine Corps—reinforce service stovepipes. To better ensure a more joint perspective, they recommend a more diverse JROC, with representatives from other department-level organizations and the combatant commands.¹⁴

Resource allocation decisions are made through a separate process—the Planning, Programming, Budgeting, and Execution system (PPBE)—which hinders the department’s ability to weigh the relative costs, benefits, and risks of investing in new weapon systems early on. Within the PPBE system, the individual military services are responsible for budgeting and allocating resources under authority that is commonly understood to be based on Title 10 of the United States Code.¹⁵ PPBE is structured by military service and defense program, although the department integrates data on the services’ current and projected budget requests under 11 crosscutting mission areas called Major Force Programs. The cross-cutting view provided by the Major Force Program structure is intended to facilitate a strategic basis for resource allocation, allowing the Secretary of Defense to more easily see where the greatest mission needs are and to re-allocate funds to meet those needs regardless of which service stands to gain or lose. However, we have reported in the past that the Major Force

¹³Institute for Defense Analyses, *Improving Integration of Department of Defense Processes for Capabilities Development and Planning* (Sept. 2006); Center for Strategic and International Studies, *Beyond Goldwater-Nichols: Defense Reform for a New Strategic Era*, Phase 1 Report (Mar. 2004); and Joint Defense Capabilities Study Team (DOD), *Joint Defense Capabilities Study: Improving DoD Strategic Planning, Resourcing and Execution to Satisfy Joint Capabilities*. Final Report (Jan. 2004).

¹⁴Assessment Panel of the Defense Acquisition Performance Assessment Project for the Deputy Secretary of Defense, *Defense Acquisition Performance Assessment Report* (Jan. 2006); Center for Strategic and International Studies, *Beyond Goldwater-Nichols: U.S. Government and Defense Reform for a New Strategic Era*, Phase 2 Report (July 2005); and M. Thomas Davis, “The JROC: Doing What? Going Where?” *National Security Studies Quarterly* (Summer 1998).

¹⁵Sections 3013, 5013, and 8013 of Title 10 grant authority to the Secretaries of the Army, the Navy, and the Air Force, respectively, to conduct all affairs of their departments, including recruiting, organizing, supplying, equipping, training, servicing, mobilizing, demobilizing, administering, maintaining, and military construction and maintenance.

Program structure has not provided sufficient visibility in certain mission areas.¹⁶ Moreover, although they cut across the services, the program mission areas are not consistent with the more recently established capability areas used in the JCIDS process,¹⁷ and as a result, it is difficult to relate resources to capabilities. For example, in prior work, we observed that the Major Force Programs contain large numbers of programs with varied capabilities, complicating comparisons needed to understand defense capabilities and associated trade-off decisions.¹⁸ We have recommended that DOD report funding levels for defense capabilities in its Future Years Defense Program report to the Congress, which is currently organized by the Major Force Programs.

In addition, our analysis of DOD's investment accounts—which pay for developing, testing, and buying weapon systems and other equipment—indicates that DOD generally does not allocate resources on a strategic basis. Figure 5 illustrates that the service allocations as a percentage of the department's overall investment budget have remained relatively static for the 25-year period we examined, even though DOD's strategic environment and warfighting needs have changed dramatically during that time, with the demise of the cold war and the emergence of the global war on terror.¹⁹ In contrast, successful commercial companies using portfolio management would expect to see their resource allocations across business areas to reflect changes in the marketplace and the competitive environment.

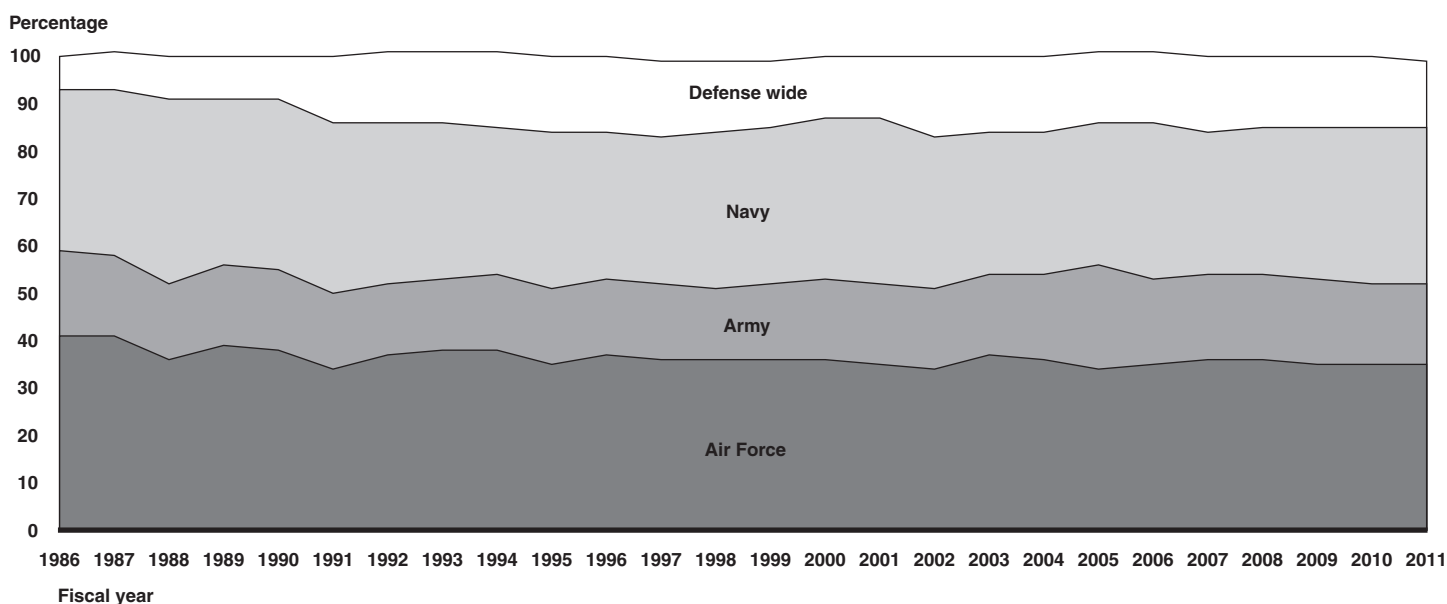
¹⁶ GAO, *Military Transformation: Actions Needed by DOD to More Clearly Identify Triad Spending and Develop a Long-term Investment Approach*, [GAO-05-540](#) (Washington, D.C.: June 30, 2005).

¹⁷ The Major Force Programs are as follows: Strategic Forces; General Purpose Forces; Command, Control, Communications, and Intelligence; Mobility Forces; Guard and Reserve Forces; Research and Development; Central Supply and Maintenance; Training, Medical, and other General Personnel Activities; Administration and Associated Activities; Support of Other Nations; and Special Operations Forces.

¹⁸ GAO, *Future Years Defense Program: Actions Needed to Improve Transparency of DOD's Projected Resource Needs*, [GAO-04-514](#) (Washington, D.C.: May 7, 2004).

¹⁹ The fiscal framework of the federal government constrains DOD's ability to totally control its investment allocations. Ultimately resource allocation decisions are made by the Congress in the annual authorization and appropriations process.

Figure 5: Service Allocations of DOD's Investment Budget (FY1986 through FY2011)



Source: DOD (data); GAO (analysis and presentation).

PPBE and JCIDS are led by different organizations (see fig. 6), as is the third of the three processes involved in DOD's weapon system investment decisions, the Defense Acquisition System (DAS), making it difficult to hold any one person or organization accountable for investment outcomes. The 2006 Quadrennial Defense Review highlighted the need for governance reforms,²⁰ and a 2006 study commissioned by DOD observed that the budget, acquisition, and requirements processes are not connected organizationally at any level below the Deputy Secretary of Defense, concluding that this structure induces instability and erodes accountability.²¹ The Under Secretary of Defense/Acquisitions, Technology, and Logistics (USD/AT&L) has stated that weapon system investment decisions are a shared responsibility, and, therefore, no one

²⁰The 2006 Quadrennial Defense Review led to the Institutional Reform and Governance project, which is focusing on (1) integrating core decision processes, (2) aligning and focusing the department's governance and management functions under an integrated enterprise model, as well as (3) establishing a common and authoritative analytical framework to link strategic decisions to execution.

²¹Assessment Panel of the Defense Acquisition Performance Assessment Project for the Deputy Secretary of Defense, *Defense Acquisition Performance Assessment Report* (January 2006).

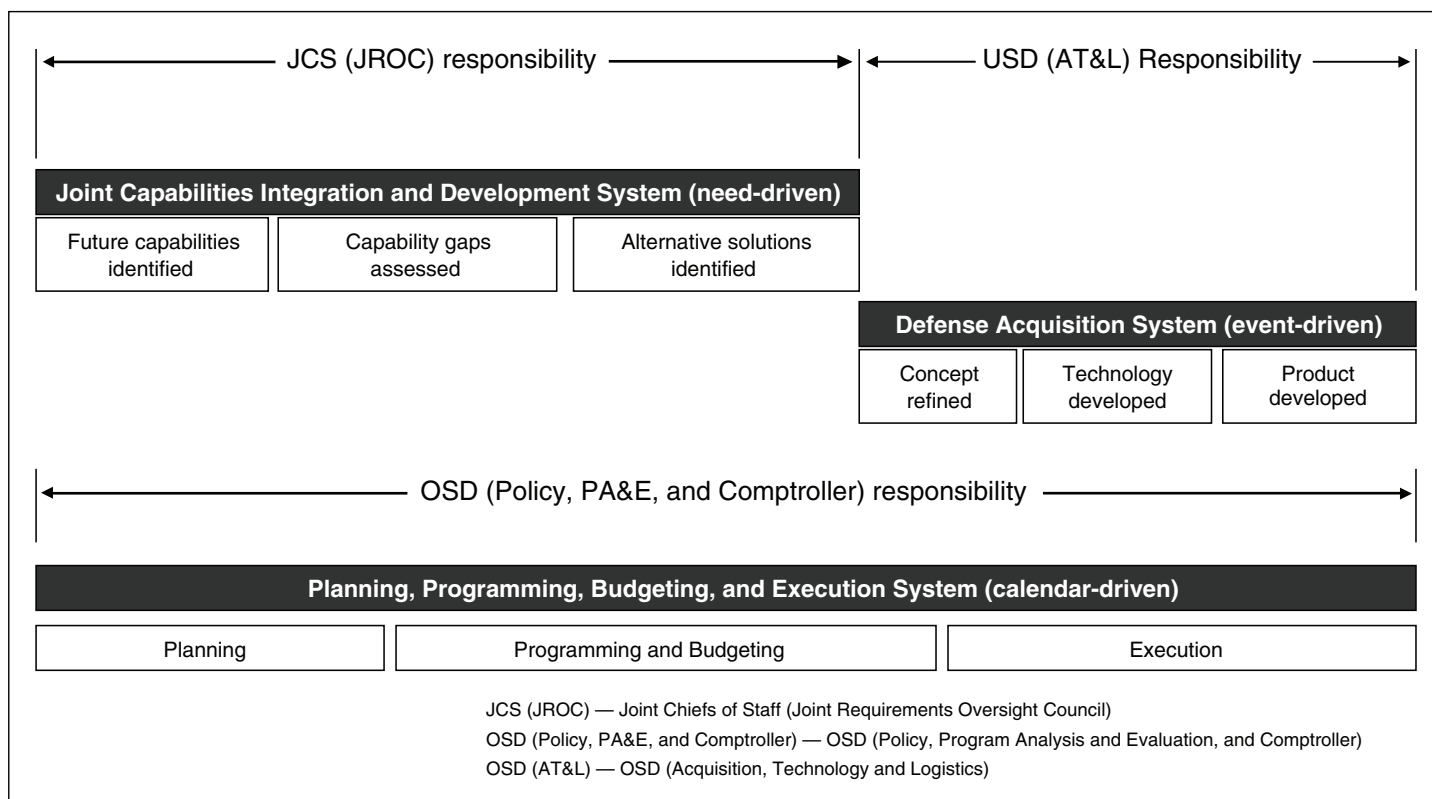
individual is accountable for these decisions. At a broader, strategic level, we have stated in prior work that DOD has lacked sustained leadership and accountability for various department-wide management reform efforts,²² including the establishment of an effective risk management approach as a framework for decision making.²³ This approach would link strategic goals to plans and budgets, assess the value and risks of various courses of action as a tool for setting investment priorities and allocating resources at the department level, and use performance measures to assess outcomes. To address the lack of sustained leadership, we have supported legislation to create a chief management official at DOD.²⁴

²²GAO, *Department of Defense: Sustained Leadership Is Critical to Effective Financial and Business Transformation*, [GAO-06-1000T](#) (Washington, D.C.: Aug. 3, 2006); and *Department of Defense: Further Actions Are Needed to Effectively Address Business Management Problems and Overcome Key Business Transformation Challenges*, [GAO-05-140T](#) (Washington, D.C.: Nov. 18, 2004).

²³GAO, *Defense Management: Additional Actions Needed to Enhance DOD's Risk-Based Approach for Making Resource Decisions*, [GAO-06-13](#) (Washington, D.C.: Nov. 15, 2005).

²⁴S. 780, 109th Cong. §1 (2005).

Figure 6: Governance of DOD's Investment Process



Source: DOD (data); GAO (analysis and presentation).

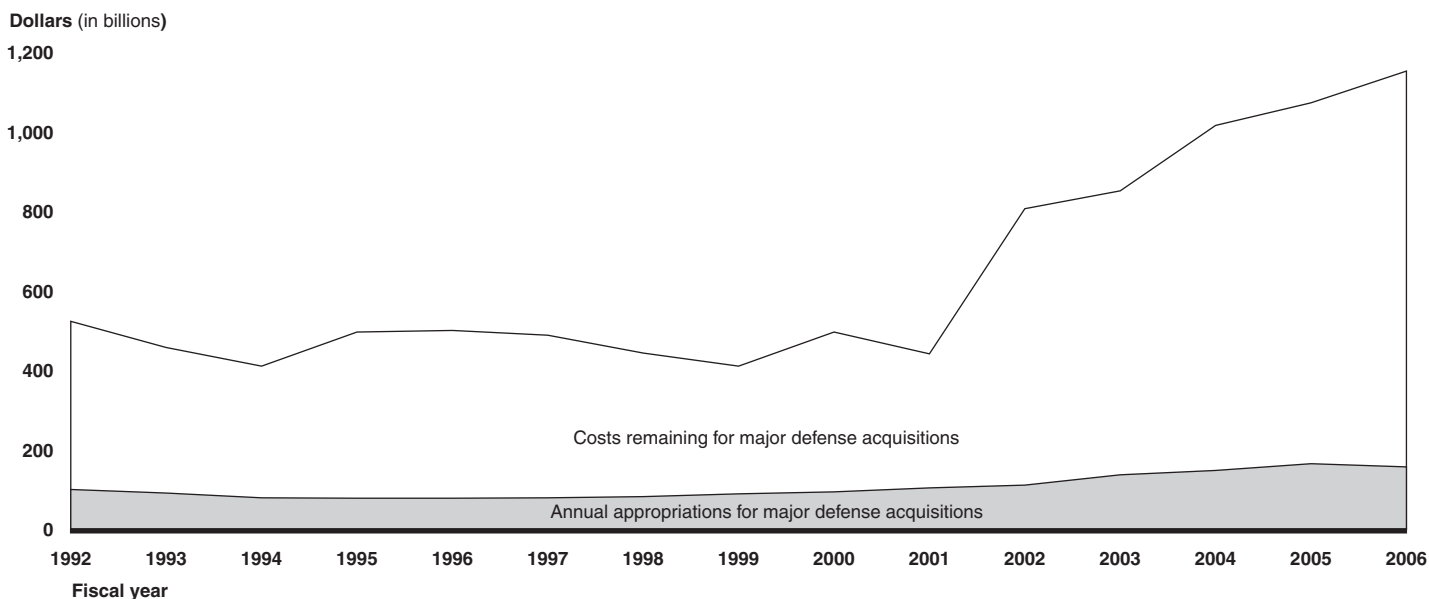
The Office of the Secretary of Defense (OSD) does not assess the funding implications of a proposed program at the front end of the investment process, when it is initially validated by JROC. JCIDS is a continuous, need-driven process that unfolds in response to warfighting needs as they are identified. However, PPBE is a calendar-driven process comprised of phases that occur over a 2-year cycle, thus OSD's formal review of a proposed program is not often synchronized with JROC's, and can occur several years later.²⁵ Nevertheless, according to Joint Staff and AT&L officials we met with, proposed programs begin to gain momentum when they are validated by JROC, and they become very difficult to stop. These officials indicated that momentum begins to gather because the services

²⁵DAS is an event-driven process structured into discrete phases separated by major decision points called milestones that can be tailored to individual programs.

start programming and budgeting for the proposed capability right away to secure funding, generally several years before actual product development begins and before OSD formally reviews the services' programming and budgeting proposals. In the interim, the services have not only budgeted for their proposed programs, but established a program office, conducted their Analysis of Alternatives, and identified specific user requirements. OSD's programming and budgeting review occurs at the back end of the investment process, when it is difficult and disruptive to make changes, such as terminating existing programs to pay for new, higher priority programs.

These practices have contributed to the department starting more programs than its resources can support. DOD defers much of the additional cost of its programs into the future, resulting in what some have characterized as a fiscal bow wave (illustrated in fig. 7). This bow wave has grown at a pace that greatly exceeds DOD's annual funding increases. The cost remaining for DOD's major weapons programs increased almost 135 percent between 1992 and 2006, while the department's annual funding level only increased 57 percent over that same time period. If this trend goes unchecked, Congress will likely be faced with a difficult choice: pull funds from other high-priority federal programs to support DOD's acquisitions or accept less warfighting capability than originally promised.

Figure 7: Costs Remaining Versus Annual Appropriations for Major Defense Acquisitions



Source: DOD (data); GAO (analysis and presentation).

DOD Commits to a Solution Earlier and with Less Knowledge

DOD commits to a solution to address a warfighting need earlier in the investment process than commercial companies do and before it has adequate knowledge about cost and technical feasibility. Proposed options for resolving a gap in military capability are submitted in an Initial Capabilities Document (ICD). DOD guidance states that this document should contain a range of approaches based in part on the cost and technological feasibility posed by the approaches, laying the foundation for a more detailed Analysis of Alternatives to be conducted under the Defense Acquisition System. In addition, JROC is to receive a briefing on the ICD that follows a standard format and addresses such issues as

- linkage of the proposal to strategic guidance;
- the time frame within which the capability is needed;
- the threat/operational environment;
- risks and assumptions (including the risk associated with proceeding and not proceeding with solutions to each); and
- a description of the best materiel and non-materiel approaches based upon cost, efficacy, performance, technology maturity, and risk.

Although DOD guidance calls for the analysis of a solution's cost and feasibility, we found that ICDs contained little of this type of information. Several DOD officials we met with, who are directly involved in the JCIDS process, did not believe cost and feasibility information was mandated at this point. In our review of 14 unclassified ICDs approved by JROC from 2003-06, we found that 11 did not contain acquisition cost estimates and 12 did not contain estimates of the technical feasibility of proposed solutions.²⁶ We also found that JCIDS guidance does not specify the level of accuracy sought in cost and feasibility estimates, and a white paper that does provide recommendations in this regard is advisory.²⁷

We found that ICDs generally focused on the strategic, or operational, relevance of proposed solutions, but a lack of guidance and an evolving methodology have raised questions about the accuracy of data supporting those assessments. JCIDS uses new joint warfighting concepts²⁸ to translate top-level military strategy into the capabilities a commander might need on the battlefield. The joint concepts underpin a capabilities-based approach²⁹ to identifying requirements, in which analyses are expected to focus on broad military capabilities rather than service-specific platforms. However, the joint concepts and capabilities-based assessments are works in progress. The concepts are being updated due to concerns about their scope, and guidance on conducting a capabilities-

²⁶The 14 ICDs we reviewed are related to weapon systems and were finalized after June 24, 2003 (the publication date for the initial JCIDS instruction). They are unclassified ACAT I, II, or III ICDs contained in the Joint Staff's Knowledge Management Decision Support Tool database, which serves in part as a repository for JCIDS documents.

²⁷The white paper suggests roughly characterizing the 20-year-lifecycle costs of proposed solutions in terms of developmental costs, facility or infrastructure costs, per-unit and rough force-level acquisition costs, and recurring operating costs. It states that rough estimates of the technical feasibility of proposed solutions should be developed, not at the engineering level because of the broad range of possibilities, but at the least to characterize as no risk, very low risk, low risk, medium risk, and high risk using legitimate technology experts. "Whitepaper on Conducting a Capabilities-Based Assessment Under the Joint Capabilities Integration and Development System," Joint Chiefs of Staff J-8/Force Application Assessment Division (Jan. 2006).

²⁸Joint future concepts are visualizations of future operations that describe how a commander might employ warfighting capabilities to achieve effects and objectives.

²⁹The 2001 Quadrennial Defense Review directed DOD to implement a capabilities-based planning approach. Capabilities-based planning has been described as a framework for defense planning and decision making in a strategic environment characterized by uncertainty and a fiscal environment characterized by limited resources. See Paul K. Davis, *Analytic Architectures for Capabilities-Based Planning, Mission System Analysis, and Transformation* (Santa Monica, Calif.: RAND, 2002).

based analysis has been lacking. Several DOD officials we met with stated that assessments vary in their rigor, and a senior Joint Staff official said that training on requirements development is one of three central challenges at present. In January 2007, we reported that DOD officials described concerns about the analytical framework for a capabilities-based assessment on joint seabasing, which could lead to inaccurately identifying gaps in implementing the concept.³⁰ Enhancing a seabasing capability is expected to be costly and could be the source of billions of dollars of investment if DOD chooses an option involving the development of new ships.

DOD does not consistently follow a disciplined review process to ensure that proposed solutions are making progress toward an executable development program, although DOD policy emphasizes that such reviews are necessary.³¹ DOD's policy identifies several key decision points prior to starting a new weapon system development program:

- an initial decision point, where the Initial Capabilities Document is reviewed, validated, and approved by the JROC;
- a Concept Decision review, where entry into the concept refinement phase of the Defense Acquisition System should be authorized; and
- a Milestone A decision point, where a preferred solution and a technology development strategy should be reviewed and approved.³²

Since Initial Capabilities Documents generally do not contain information on cost and technical feasibility, the JROC does not have a sufficient basis

³⁰GAO, *Force Structure: Joint Seabasing Would Benefit from a Comprehensive Management Approach and Rigorous Experimentation before Services Spend Billions on New Capabilities*, [GAO-07-211](#) (Washington, D.C.: Jan. 26, 2007). Joint seabasing is one of several evolving concepts describing how commanders in the future will project and sustain forces for conducting joint military operations without relying on immediate access to nearby land bases.

³¹CJCSI 3170.01E, Joint Capabilities Integration and Development System; DODI 5000.2, Operation of the Defense Acquisition System.

³²The JROC has another decision point just prior to program initiation, when it reviews, validates, and approves a Capabilities Development Document. Approval and validation of a Capabilities Development Document is a key entrance criteria for initiating a new development program at Milestone B. We did not include the Capabilities Development Document decision point in our current review because it is closely associated with Milestone B, the focus of many of our former reviews. See the list of related GAO products on the last pages of this report.

for making go/no-go decisions at the initial decision point. In the 4 years since JCIDS was implemented, nearly all of the warfighting needs identified by the services and submitted for review in an ICD have been validated and sent into the acquisition pipeline for further analysis as potential programs, which calls into question whether go/no-go decisions are the point of this first key gate. Information on cost and feasibility is generally developed after the ICD is approved and proposed solutions undergo further refinement through an Analysis of Alternatives (AOA). An AOA should compare alternative solutions in terms of life-cycle cost, schedule, and operational effectiveness, leading up to the identification of a preferred alternative. However, officials from PA&E and the Joint Staff indicate that AOAs often make a case for a single preferred solution. Several of them indicated other concerns about AOAs, such as not setting up trade-off discussions, lack of analytical rigor, length, and timeliness.

In any case, the next review points—the Concept Decision and Milestone A—are often skipped; thus, the opportunity to review an evolving business case and to make go/no-go decisions is bypassed. In prior work, we found that 80 percent of the programs we reviewed entered the Defense Acquisition System at Milestone B without holding any prior major reviews, such as a Milestone A review.³³ Such reviews are intended to provide acquisition officials with an opportunity to assess whether program officials had the knowledge needed to develop an executable business case. Senior officials with OSD confirmed that this is a common practice among defense acquisition programs. We concluded that this practice eliminates a key opportunity for decision makers to assess the early product knowledge needed to establish a business case that is based on realistic cost, schedule, and performance expectations. In addition, we found that programs are regularly approved to begin development even though officials reported levels of knowledge below the criteria suggested in DOD's acquisition policy.

There is, then, generally little department-level oversight between the point at which an ICD is approved and when system-level requirements are validated and product development is initiated. At this point, as we indicated earlier, there is generally no turning back, because the services have invested considerable time and money, established a budget, and

³³ GAO, *Defense Acquisitions: Major Weapon Systems Continue to Experience Cost and Schedule Problems under DOD's Revised Policy*, [GAO-06-368](#) (Washington, D.C.: Apr. 13, 2006). Our review focused on the Concept Decision and Milestone A reviews points and did not assess the extent to which JROC reviews were held.

formed a constituency for a proposed program, and decision makers become reluctant to terminate a program or send it back for further study.

DOD Is Piloting Several Initiatives to Address Disconnects in Investment Decision-making

In response to the 2006 Quadrennial Defense Review and other recent acquisition reform studies,³⁴ DOD has undertaken several key, interrelated initiatives intended to strengthen the department's approach to investment decisions. The initiatives include (1) taking a new approach to reviewing proposed concepts that will provide decision makers with an early opportunity to evaluate trade-offs among alternative approaches to meeting a capability need, (2) testing portfolio management approaches in selected capability areas to facilitate more strategic choices about how to allocate resources across programs, and (3) using capital budgeting as a potential means to stabilize program funding. While promising, these initiatives do not fundamentally change DOD's existing service-centric framework for making weapon system investment decisions.

To address a perceived gap between DOD's major decision-making processes and provide a department-level means to assess potential solutions (materiel and non-materiel) to fill a validated capability need, DOD is testing a new approach to a Concept Decision review, which will take place after a warfighting need is validated by the JROC. This new approach is intended to focus attention on the affordability and feasibility of potential solutions and generate early cost, schedule, and performance trade-offs prior to the point of a significant investment commitment. As currently proposed, the Concept Decision will be informed by a newly required Evaluation of Alternatives that will integrate the Functional Solutions Analysis conducted under JCIDS with the Analysis of Alternatives conducted under the acquisition system and lay out the relative merits and limitations of potential solutions. Furthermore, concept decision reviews will be implemented by a tri-chair board consisting of lead decision makers from the JCIDS, PPBE, and DAS processes. While promising, the Concept Decision review largely reinstitutes a review point that already existed but was only intermittently used. For Concept Decision reviews to be effective, DOD will have to establish enforcement and accountability mechanisms to ensure the reviews are actually implemented. In addition, the extent to which the concept reviews can

³⁴ *Defense Acquisition Performance Assessment* (January 2006); *Defense Science Board Summer Study on Transformation: A Progress Assessment* (February 2006); *Beyond Goldwater-Nichols: U.S. Government and Defense Reform for a New Strategic Era, Phase 2 Report* (July 2005); and *Joint Defense Capabilities Study* (January 2004).

achieve desired effects will depend on what authority Concept Decisions carry and who will be held accountable, particularly in light of the service-dominated investment structure that currently exists.

The department has also begun to pilot-test capability-based portfolio management, selecting four joint capability areas to focus on—joint command and control, joint net-centric operations, battlespace awareness, and joint logistics. The intent is to enable the department to develop and manage capabilities, as opposed to simply individual programs, and enhance the integration and interoperability within and across sets of capabilities. Each portfolio is being structured somewhat differently to help the department determine how best to proceed with portfolio management. All, however, are intended to focus initially on existing programs and to operate within DOD's existing decision-making framework. The portfolios are largely advisory and will, as a first step, provide input to decisions made through the JCIDS, PPBE, and DAS processes. At this point, the capability portfolio managers have not been given direct authority to manage fiscal resources and make investment decisions. Without portfolios in which managers have authority and control over resources, DOD is at risk of continuing to develop and acquire systems in a stovepiped manner and of not knowing whether its systems are being developed within available resources.

DOD is also examining the use of capital accounts as a potential means of stabilizing program funding, which has long been cited as a significant issue in program management. This capital budgeting pilot initiative is in the early stages of planning, and the specifics of how such accounts will be implemented are being developed, but the intent is for DOD to commit a set amount of funding for the development portion of a project and hold to that commitment by not adjusting funding up or down until the product is delivered. In addition to resource constraints, programs would be given a fixed amount of time to get from one milestone to the next. If successful, this initiative could represent a step toward stabilizing long-term costs within major defense acquisition programs, as well as a strengthening of the ability of program managers to conduct long-term planning and control costs. However, for this initiative to be effective, DOD will need to overcome long-standing problems it has had in starting programs without sufficient knowledge of the costs, requirements, and technologies needed to develop proposed weapon systems. Unless this changes, it is unlikely that capital accounts will lead to increased program stability.

Conclusions

While DOD has increasingly strengthened its ability to operate as a joint force on the battlefield, the department's organizational structures, processes, and practices for planning and acquiring weapon systems are not similarly joint. Put simply, DOD largely continues to base its investment decisions on service-driven analyses that do not provide an enterprise-level understanding of overall warfighting needs and on individual platforms rather than broader sets of capabilities. In contrast, successful commercial companies use an integrated portfolio management approach to focus early investment decisions on products collectively at an enterprise level and to ensure there is a sound basis to justify the commitment of resources. By following a disciplined, integrated process—where the relative pros and cons of market opportunities and competing product proposals are assessed based on available resources and customer needs, and where tough decisions about which investments to pursue are made—companies are able to reduce duplication between business units, move away from organizational stovepipes, and effectively support each new development program they commit to. Until DOD takes a joint, portfolio management approach to weapon system acquisition—with functionally aligned entities that have the requisite responsibility, authority, and control over resources—it will continue to struggle to effectively prioritize warfighting needs, make informed trade-offs, and achieve a balanced mix of weapon systems that are affordable, feasible, and provide the best military value to the warfighter. Committing to more programs than the budget can support and approving programs based on insufficient knowledge to effectively manage risks will further delay providing critical capabilities to the warfighter and lead to lost opportunities to address other current and emerging needs.

Recommendations

We recommend that the Secretary of Defense implement an enterprise-wide portfolio management approach to making weapon system investments that integrates the assessment and determination of warfighting needs with available resources and cuts across the services by functional or capability area. To ensure the success of such an approach, the Secretary should establish a single point of accountability at the department level with the authority, responsibility, and tools to ensure that portfolio management for weapon system investments is effectively implemented across the department.

In addition, the Secretary should ensure that the following commercial best practices, identified in this report, are incorporated:

-
- implement a review process in which needs and resources are integrated early and in which resources are committed incrementally based on the achievement of specific levels of knowledge at established decision points;
 - prioritize programs based on the relative costs, benefits, and risks of each investment to ensure a balanced portfolio;
 - require increasingly precise cost, schedule, and performance information for each alternative that meets specified levels of confidence and allowable deviations at each decision point leading up to the start of product development;
 - establish portfolio managers who are empowered to prioritize needs, make early go/no-go decisions about alternative solutions, and allocate resources within fiscal constraints; and
 - hold officials at all levels accountable for achieving and maintaining a balanced, joint portfolio of weapon system investments that meet the needs of the warfighter within resource constraints.

We also recommend that the Secretary take steps to support department-level decision makers and portfolio managers by developing a stronger joint analytical capability to assess and prioritize warfighting needs.

Agency Comments and Our Evaluation

DOD provided us with written comments on a draft of this report. The comments appear in appendix II.

DOD concurred with the majority of our recommendations and partially concurred with two. Generally, in responding to these recommendations, DOD stated that it is undertaking several initiatives and pilot efforts to improve the department's approach to investment and program decision making, and that implementation of any new business rules will be contingent upon the outcome of these initiatives. The department also stated that it is experimenting with portfolio management, related authorities and organizational constructs, and integrated decision-making processes.

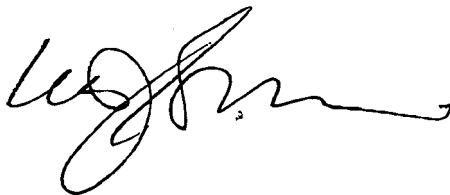
We believe that these initiatives and pilot efforts may be steps in the right direction, but we are concerned that they do not go far enough to address the systemic cultural and structural problems identified in this report. DOD has attempted many similar acquisition reform efforts over the past 3

decades, including significant revisions to both defense requirements and acquisition policy. However, despite these efforts, weapon system acquisition programs continued to experience cost overruns, schedule slips, and performance shortfalls. The department's current initiatives are likely to face the same fate because they do not fundamentally change DOD's service-centric framework or sufficiently integrate its decision-making processes for making weapon system investments.

DOD did not provide comments regarding our recommendation that the Secretary establish a single point of accountability at the department level with the authority, responsibility, and tools to ensure that portfolio management for weapon system investments is effectively implemented across the department. We believe that a single point of accountability is necessary to successfully implement a portfolio management approach and integrate DOD's fragmented decision-making processes under one senior official who is accountable for weapon system investment outcomes. We further believe that our recommendations would better position DOD to make tough, knowledge-based choices among potential weapon system investments.

We are sending copies of this report to the Secretary of Defense; the Secretaries of the Air Force, Army, and Navy; and the Director of the Office of Management and Budget. We will provide copies to others on request. This report will also be available at no charge on GAO's Web site at <http://www.gao.gov>.

If you have any questions about this report or need additional information, please call me at (202) 512-4841 (sullivanm@gao.gov). Key contributors to this report were John Oppenheim, Assistant Director; Lily Chin; John Krump; Matthew Lea; Travis Masters; Sean Seales; Karen Sloan; Susan Woodward; and Rebecca Yurman.

A handwritten signature in black ink, appearing to read 'Michael J. Sullivan', with a stylized, flowing script.

Michael J. Sullivan
Director, Acquisition
and Sourcing Management

Appendix I: Objectives, Scope, and Methodology

This report examines the Department of Defense's (DOD) requirements identification and resource allocation processes for major weapons systems. The primary focus is on identifying successful private-sector principles and practices that could be adopted by DOD to help improve stability in weapon system acquisition programs. Specifically, our objectives were to (1) identify best practices of successful commercial companies for ensuring that they pursue the right mix of programs to meet the needs of their customers within resource constraints and (2) compare DOD's enterprise-level processes for investing in weapon systems to those practices. Our work was conducted between March 2006 and February 2007, in accordance with generally accepted government auditing standards.

We analyzed the outputs of DOD's investment decision-making support processes—the requirements determination process known as JCIDS and the resource allocation process known as PPBE—using criteria established in DOD policy and in previous GAO reports. We identified impacts of the existing processes by analyzing quantitative and qualitative data on DOD spending trends, conducting interviews with DOD officials, and reviewing previous reports by GAO and by other knowledgeable audit and research organizations. In addition, we met with officials representing the Office of the Secretary of Defense, Joint Staff, and military services. At each of these locations, we conducted interviews that helped us describe the current condition of DOD's requirements identification and resource allocation processes. We also reviewed DOD and military service policies and funding documents pertaining to the DOD requirements identification process and resource allocation decisions for major weapons systems. Specifically, we reviewed the contents of 14 unclassified Initial Capability Documents that were finalized after June 24, 2003—the publication date for the JCIDS instruction—to assess the extent to which they contained cost and technical feasibility information. Those 14 ICDs were unclassified, weapon system-related ACAT I, II, or III ICDs that were contained in the Joint Staff requirements database. We relied on previous GAO reports that highlight both the symptoms and causes of unstable requirements and funding in DOD weapons acquisition programs. A list of these reports can be found at the end of this report. In addition, we reviewed recent key studies and reports addressing acquisition reform issues by the Center for Strategic International Studies, Institute for Defense Analysis, the U.S. Naval War College, the Defense Acquisition Performance Assessment Project, the Joint Defense Capabilities Study Team, the Joint C4ISR Decision Support Center, the Defense Science Board, and the 2001 and 2005 Quadrennial Defense Reviews.

We also reviewed pertinent literature from authoritative corporate, academic, and professional organizations, to identify commercial best practices and processes that could be used by DOD to improve its weapon system investment decision-making processes. In addition we conducted case studies of five leading commercial companies. In selecting them, we sought to identify companies that were recognized in the literature for best practices, had large and diversified portfolios of products, and make significant investments in the development and production of new products. For each of the companies, we interviewed management officials knowledgeable about their requirements identification and resource allocation activities, to gather consistent information about processes, practices, and metrics the companies use to help achieve successful product development outcomes. Below are descriptions of the five companies featured in this report:

Motorola

Motorola is a Fortune 100 global communications leader that provides seamless mobility products and solutions across broadband, embedded systems, and wireless networks. According to Motorola's 2005 Corporate Profile, the company is the market leader in mission critical wireless communication systems, two-way radios, embedded telematics systems, digital set-top shipments, cable modem shipments, digital head-ends, embedded computer systems for communication applications, CDMA infrastructure sales (excluding the United States), and second in world wide wireless handsets. Motorola achieved net sales of \$31.323 billion and spent \$3.060 billion on research and development in 2004. The corporation has approximately 68,000 employees, in 320 facilities, spanning 73 countries. We met with the management of Motorola's Government & Enterprise Mobility Solutions and Global Telecom Solutions sectors in Schaumburg, Illinois.

International Business Machines (IBM)

IBM is one of the world's largest technological companies, spending about \$3 billion annually on research and development activities. It is the largest supplier of hardware, software, and information technology services. With 3,248 U.S. patents, IBM earned more patents than any other company for the 12th consecutive year in 2004. In the past 4 years, IBM inventors received more than 13,000 patents—approximately 5,400 more than any other patent recipient. IBM has over 329,000 employees worldwide. We met with managers from IBM Integrated Product Development (IPD) in Somers, New York.

Procter & Gamble (P&G)

Procter & Gamble Corp. (P&G) is a leading producer of consumer goods. It currently leads in global sales and marketshare among all fabric care, baby care, feminine care, and hair care products. It currently has over 130,000 employees in 80+ countries. Twenty-two of its brands have annual gross sales exceeding \$1 billion each. In fiscal year 2005/2006, P&G invested \$2.075 billion or 3 percent of net sales in research and development (R&D). This ranks them as one of the top 20 largest research & development investors among U.S.-based companies. P&G has more Ph.D.s working in labs around the world than the combined science and engineering faculties of Harvard, MIT, and Berkeley. We met with the management of P&G's New Initiative Delivery team in Cincinnati, Ohio.

Eli Lilly Corporation

Eli Lilly is a global pharmaceutical company and one of the world's largest corporations. It was founded over 130 years ago and currently employs approximately 42,000 people worldwide, including 13,991 employed at its headquarters in Indianapolis, Ind. Approximately 8,336 employees (19 percent of the total work force) are engaged in research and development (R&D); clinical research is conducted in over 50 countries; there are R&D facilities in 9 countries; and manufacturing plants in 13 countries. Its products are marketed in 143 countries. Lilly's net sales in 2005 were \$14.6 billion. Eli Lilly strives to grow sales by 6 percent to 7 percent each year. In 2005, \$3 billion was spent on R&D, a \$334.4 million increase from the previous year. Currently, R&D represents 20.7 percent of sales. Lilly's total R&D investment in the last 5 years from continuing operations was \$12.5 billion. We met with managers from Eli Lilly's Corporate Headquarters in Indianapolis, Ind.

Caterpillar Corporation

Caterpillar is a technology leader and the world's leading manufacturer of construction and mining equipment, diesel and natural gas engines, and industrial gas turbines. In 2005, its total sales and revenues were \$36.3 billion, and its total R&D expenditures exceeded \$1 billion, compared with \$20.5 billion sales and \$696 million R&D in 2001. Between 2001 and 2005, the average return on equity of its stockholders' shares more than doubled. Caterpillar has over 85,000 employees, and over 105,000 people are employed by Caterpillar's dealers worldwide. We met with managers responsible for Caterpillar's New Product Introduction (NPI) process in Peoria, Illinois.

Appendix II: Comments from the Department of Defense



ACQUISITION,
TECHNOLOGY
AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

MAR 21 2007

Mr. Michael J. Sullivan
Director, Acquisition and Sourcing Management
U. S. Government Accountability Office
441 G. Street, N.W.
Washington, DC 20548

Dear Mr. Sullivan:

This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-07-388 "BEST PRACTICES: An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DoD's Acquisition Outcomes," dated February 14, 2007 (GAO Code 120516).

The DoD concurs with five recommendations and partially concurs with two of the draft report recommendations. The rationale for our position is included in the enclosure.

We appreciate the opportunity to comment on the draft report. My point of contact for this effort is Mr. David Crim, (703) 697-5385, david.crim@osd.mil

Sincerely,

Dave G. Ahern
Director
Portfolio Systems Acquisition

Enclosure:
As stated



GAO DRAFT REPORT DATED FEBRUARY 14, 2007
GAO-07-388 (GAO CODE 120516)

"BEST PRACTICES: AN INTEGRATED PORTFOLIO
MANAGEMENT APPROACH TO WEAPON SYSTEM
INVESTMENTS COULD IMPROVE DOD'S ACQUISITION
OUTCOMES"

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense implement an enterprise-wide portfolio management approach to making weapon system investments that integrates the assessment and determination of warfighting needs with available resources and cuts across the services by functional or capability area. (p. 25/GAO Draft Report)

DOD RESPONSE: Concur. As noted in the report, in response to the 2006 Quadrennial Defense Review (QDR) and other recent acquisition reform studies, the DoD is undertaking several initiatives and pilot activities to improve the department's approach to investment and program decision making. These initiatives take into account many of the best practices employed by commercial industry as described in the report, including corporate-level priorities, a framework linking strategic goals to plans and budgets, and performance metrics. Implementation of any new business rules will be contingent upon the outcome of these pilot initiatives, a thorough understanding of the best overall approach, and the overall benefits gained.

RECOMMENDATION 2: The GAO recommended that the Secretary of Defense implement a review process in which needs and resources are integrated early and in which resources are committed incrementally based on the achievement of specific levels of knowledge at decision points. (p. 26/GAO Draft Report)

DOD RESPONSE: Concur. As noted in the report, in response to the 2006 QDR and other recent acquisition reform studies, the DoD is undertaking several initiatives and pilot activities to integrate the department's major decision processes. Concept Decision and Capital Accounts are two examples of such initiatives that are consistent with this report recommendation. Foundational to these and other pilot activities is available knowledge to support senior leader decision making at key points in the life cycle. The Department's efforts to promote transparent data, along with its major decision processes support the incremental commitment of resources. Implementation of any new business rules will be contingent upon the outcome of these initiatives, a thorough understanding of the best overall approach and the overall benefits gained.

Attachment
Page 1 of 3

RECOMMENDATION 3: The GAO recommended that the Secretary of Defense prioritize programs based on the relative costs, benefits, and risks of each investment to ensure a balanced portfolio. (p. 26/GAO Draft Report)

DOD RESPONSE: Partially Concur. As noted in the report, in response to the 2006 QDR and other recent acquisition reform studies, the DoD is undertaking several initiatives to enable strategic choice. This involves balancing resources at three levels: strategic, portfolio and program levels. Implementation of any new business rules will be contingent upon the outcome of initiatives focused in this area, a thorough understanding of the best overall approach and the overall benefits gained.

RECOMMENDATION 4: The GAO recommended that the Secretary of Defense require increasingly precise cost, schedule, and performance information for each alternative that meet specified levels of confidence and allowable deviations at each decision point leading up to the start of product development. (p. 26/GAO Draft Report)

DOD RESPONSE: Concur. As noted in the report, in response to the 2006 QDR and other recent acquisition reform studies, the DoD is undertaking several initiatives and pilot activities to improve the department's approach to investment and program decision making. Implementation of any new business rules will be contingent upon a thorough understanding of the best overall approach and the overall benefits gained.

RECOMMENDATION 5: The GAO recommended that the Secretary of Defense establish portfolio managers who are empowered to prioritize needs, make early go/no-go decisions about alternative solutions, and allocate resources within fiscal constraints. (p. 26/GAO Draft Report)

DOD RESPONSE: Partially Concur. As noted in the report, in response to the 2006 QDR and other recent acquisition reform studies, the DoD is undertaking several initiatives and pilot activities to experiment with Capability Portfolio Management. We have selected four highly joint areas with which to initiate a portfolio construct, and are experimenting with their participation and integration in the Department's major processes, as well as with their authorities and organizational constructs. Implementation of any new business rules will be informed by the experience gained and information gathered from the Capability Portfolio management effort and based on a thorough understanding of the best overall approach and the overall benefits gained.

RECOMMENDATION 6: The GAO recommended that the Secretary of Defense hold officials at all levels accountable for achieving and maintaining a balanced, joint portfolio of weapon system investments that meet the needs of the warfighter within resource constraints. (p. 26/GAO Draft Report)

DOD RESPONSE: Concur. In response to the 2006 QDR, the Department developed an execution roadmap for Institutional Reform and Governance. This roadmap is aimed at improving the defense enterprise by creating more integrated and responsive decision

Attachment
Page 2 of 3

making processes, organizations and business practices. The roadmap seeks to develop a decision management approach that enables a clear and transparent link from strategy to outcomes. The approach will clearly delineate decision making responsibilities of the governance, management and execution levels of the Department. It will also enable senior leadership to focus on strategic choice and empower management to carry out their responsibilities in a manner that ensures transparency, accountability, and sound performance management. An example acquisition transformation initiative is the utilization of a senior-level Tri-Chaired Committee that integrates Department-wide acquisition processes to conduct Concept Decision Reviews. The Concept Decision Review goal is to ensure, as early as possible, that DoD is making the right corporate investment choices, balancing operational and programmatic risks, to ensure that those choices are affordable, and that any resulting non-materiel solutions and/or materiel acquisitions are designed for lifecycle success.

RECOMMENDATION 7: The GAO recommended that the DoD take steps to support department level decisions-makers and portfolio managers by developing a stronger joint analytical capability to assess and prioritize warfighting needs. (p. 26/GAO Draft Report)

DOD RESPONSE: Concur. As part of the overall Institutional Reform and Governance effort described above, we will work to improve the Department's analytic framework, build more transparent business information across the Department, integrate decision processes to enable strategic choice and align roles and responsibilities in a way that maximizes decision making effectiveness across the enterprise. As an example, the Department is continuing to develop its weapon system readiness and sustainment modeling capabilities. Such models are aimed at enhancing the ability of acquisition and sustainment professionals to assess, for example, trade-offs between alternative investments in elements such as sustainment capabilities, support structures, cycle times, reliability, and alternative policies. The goal of these modeling capabilities is to ensure that DoD can make the intelligent, informed resource application decisions that will optimize acquisition and sustainment operations and maximize achieved materiel readiness at optimum total weapon systems ownership cost. Such modeling capabilities support the ongoing integration of acquisition and sustainment activities into an end-to-end continuum.

Attachment
Page 3 of 3

Related GAO Products

Best Practices: Stronger Practices Needed to Improve DOD Technology Transition Processes. [GAO-06-883](#). Washington, D.C.: September 14, 2006.

Defense Acquisitions: Major Weapon Systems Continue to Experience Cost and Schedule Problems under DOD's Revised Policy. [GAO-06-368](#). Washington, D.C.: April 13, 2006.

DOD Acquisition Outcomes: A Case for Change. [GAO-06-257T](#). Washington, D.C.: November 15, 2005.

Defense Acquisitions: Stronger Management Practices Are Needed to Improve DOD's Software-Intensive Weapon Acquisitions. [GAO-04-393](#). Washington, D.C.: March 1, 2004.

Best Practices: Setting Requirements Differently Could Reduce Weapon Systems' Total Ownership Costs. [GAO-03-57](#). Washington, D.C.: February 11, 2003.

Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes. [GAO-02-701](#). Washington, D.C.: July 15, 2002.

Defense Acquisitions: DOD Faces Challenges in Implementing Best Practices. [GAO-02-469T](#). Washington, D.C.: February 27, 2002.

Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes. [GAO-01-288](#). Washington, D.C.: March 8, 2001.

Best Practices: A More Constructive Test Approach Is Key to Better Weapon System Outcomes. [GAO/NSIAD-00-199](#). Washington, D.C.: July 31, 2000.

Defense Acquisition: Employing Best Practices Can Shape Better Weapon System Decisions. [GAO/T-NSIAD-00-137](#). Washington, D.C.: April 26, 2000.

Best Practices: DOD Training Can Do More to Help Weapon System Programs Implement Best Practices. [GAO/NSIAD-99-206](#). Washington, D.C.: August 16, 1999.

Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes. [GAO/NSIAD-99-162](#). Washington, D.C.: July 30, 1999.

Defense Acquisitions: Best Commercial Practices Can Improve Program Outcomes. [GAO/T-NSIAD-99-116](#). Washington, D.C.: March 17, 1999.

Defense Acquisition: Improved Program Outcomes Are Possible. [GAO/T-NSIAD-98-123](#). Washington, D.C.: March 17, 1998.

Best Practices: DOD Can Help Suppliers Contribute More to Weapon System Programs. [GAO/NSIAD-98-87](#). Washington, D.C.: March 17, 1998.

Best Practices: Successful Application to Weapon Acquisition Requires Changes in DOD's Environment. [GAO/NSIAD-98-56](#). Washington, D.C.: February 24, 1998.

Best Practices: Commercial Quality Assurance Practices Offer Improvements for DOD. [GAO/NSIAD-96-162](#). Washington, D.C.: August 26, 1996.

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